

WHAT IS CLAIMED IS:

1 1. Apparatus for printing a desired image on a printing
2 medium, based upon input image data, by construction from
3 individual marks formed in a pixel grid; said apparatus
4 comprising:

5 at least one multielement incremental-printing array
6 that is subject to colorant-deposition error;

7 means for measuring such colorant-deposition error of
8 the at least one array;

9 means for modifying a multicolumn, multirow numerical
10 tabulation that forms a mapping between such input image
11 data and such marks, to compensate for the measured col-
12 orant-deposition error; and

13 means for printing using the modified mapping.

1 2. The apparatus of claim 1, wherein the mapping is
2 selected from the group consisting of:

3 an optical-density transformation of the image data
4 to such construction from individual marks; and

5 a spatial-resolution relationship between the image
6 data and such pixel grid.

1 3. The apparatus of claim 2, wherein:

2 the optical-density transformation comprises a half-
3 toning matrix; and

4 the spatial-resolution relationship comprises a scal-
5 ing of the image data to such pixel grid.

1 4. The apparatus of claim 1, wherein:
2 said at least one multielement incremental-printing
3 array comprises a plurality of multielement printing
4 arrays that print in a corresponding plurality of differ-
5 ent colors or color dilutions, each multielement printing
6 array being subject to a respective colorant-deposition
7 error; and
8 the measuring means and the mapping-modifying means
9 each operate with respect to each one of the plurality of
10 multielement printing arrays respectively.

1 5. The apparatus of claim 4, wherein:
2 for at least one of the plurality of multielement
3 printing arrays, the colorant-deposition error comprises a
4 respective pattern of printing-density defects; and where-
5 in:
6 the measuring means comprise means for measuring the
7 pattern of printing-density defects for each multielement
8 printing array respectively; and
9 the modifying means comprising means for applying the
10 respective pattern of defects, for at least one of the
11 multielement printing arrays, to modify a respective said
12 mapping.

1 6. The apparatus of claim 4, wherein:
2 for at least one of the plurality of multielement
3 printing arrays, the colorant-deposition error comprises a
4 swath-height error;
5 the measuring means comprise means for measuring the
6 swath-height error for each multielement printing array
7 respectively; and
8 the modifying means comprise means for applying the
9 respective swath-height error, for at least one of the
10 multielement printing arrays, to modify a respective said
11 mapping.

1 7. The apparatus of claim 1, wherein:
2 the colorant-deposition error comprises a pattern of
3 printing-density defects;
4 the measuring means comprise means for measuring the
5 pattern of printing-density defects;
6 the modifying means comprise:
7
8 means for deriving a correction pattern from
9 the measured pattern of printing-density
10 defects, and
11
12 means for applying the correction pattern to
13 modify a halftone thresholding process; and
14
15 the printing means comprise means for printing such
16 image using the modified halftone thresholding process.

1 8. The apparatus of claim 1, wherein:
2 the colorant-deposition error comprises a swath-
3 height error or otherwise corresponds to a optimum dis-
4 tance of printing-medium advance;
5 the measuring means comprise means for measuring the
6 swath-height error or determining the optimum distance;
7 the modifying means comprise:
8
9 means for deriving a correction pattern from the
10 measured swath-height error or determined
11 optimum distance, and
12
13 means for applying the correction pattern to
14 modify a halftone thresholding process; and
15
16 the printing means comprise means for printing such
17 image using the modified halftone thresholding process.

1 9. A method of printing a desired image, by construction
2 from individual marks formed in a pixel grid by at least
3 one multielement printing array that is subject to a pat-
4 tern of printing-density defects; said method comprising
5 the steps of:
6 measuring such pattern of printing-density defects;
7 deriving a correction pattern from the measured pat-
8 tern of printing-density defects;
9 applying the correction pattern to modify a halftone
10 thresholding process; and
11 printing such image using the modified halftone
12 thresholding process.

1 10. The method of claim 9, for use with a printmask in
2 plural-pass printing, and further comprising the steps of,
3 before or as a part of the applying step:

4 using such printmask to determine a relationship be-
5 tween the halftone matrix and the multielement array; and
6 employing the relationship in the applying step to
7 control application of the correction pattern to the half-
8 tone matrix.

1 11. The method of claim 9, wherein:

2 the printing step comprises single-pass printing.

1 12. The method of claim 9, for use with said at least one
2 multielement incremental-printing array that comprises a
3 plurality of scanning multielement printing arrays that
4 print in a corresponding plurality of different colors or
5 color dilutions, each multielement printing array being
6 subject to a respective swath-height error; and wherein:
7 the measuring, deriving, applying and printing steps
8 are employed to modify swath height of at least one of the
9 scanning multielement printing arrays, for accommodating
10 any swath-height error present in each multielement print-
11 ing array respectively.

1 13. The method of claim 9, for use with said at least one
2 multielement incremental-printing array that comprises a
3 plurality of multielement printing arrays that print in a
4 corresponding plurality of different colors or color dilu-
5 tions, each multielement printing array being subject to a
6 respective pattern of printing-density defects; and where-
7 in:

8 the measuring, deriving, applying and printing steps
9 are each performed with respect to each multielement
10 printing array respectively.

1 14. The method of claim 13, for use with such plurality
2 of multielement incremental-printing arrays that are also
3 each subject to a respective swath-height error; and
4 wherein:

5 the measuring, deriving, applying and printing steps
6 are also employed to modify swath height of at least one
7 of the multielement printing arrays, for accommodating any
8 swath-height error present in each multielement printing
9 array respectively.

1 15. The method of claim 9, wherein:

2 the halftone thresholding process comprises defini-
3 tion of a halftone matrix.

1 16. The method of claim 9, wherein:

2 the halftone thresholding process comprises an error-
3 diffusion protocol.

1 17. The method of claim 16, wherein the error-diffusion
2 protocol comprises at least one of:

3 a progressive error-distribution allocation protocol

4 of such error-diffusion halftoning; and

5 a decisional protocol for determining whether to mark
6 a particular pixel.

1 18. The method of claim 9, wherein:

2 the applying step comprises replacing values above or
3 below a threshold value.

1 19. The method of claim 9, wherein:

2 the applying step comprises multiplying values by a
3 linear factor.

1 20. The method of claim 9, wherein:

2 the applying step comprises applying a gamma cor-
3 rection function to values.

1 21. The method of claim 9, wherein the modifying step
2 comprises a combination of at least two of:

3 replacing values above or below a threshold value;
4 multiplying each values by a linear factor; and
5 applying a gamma correction function to values.

1 22. The method of claim 9, wherein:
2 for each of the plurality of multielement arrays, the
3 measuring, deriving and applying steps are each performed
4 at most only one time for a full image.

1 23. The method of claim 9, wherein:
2 the applying step comprises modifying the darkness of
3 substantially each mark printed by an individual printing
4 element whose density is defective.

1 24. The method of claim 9, wherein:
2 the applying step comprises modifying the average
3 number of dots printed by an individual printing element
4 whose density is defective.

1 25. A method of printing a desired image, based on input
2 image data, by construction from individual marks formed
3 in a pixel grid by at least one scanning multielement
4 printing array; said printing being subject to print-qual-
5 ity defects due to departure of printing-medium advance
6 from an optimum value; said method comprising the steps
7 of:
8 measuring a parameter related to such print-quality
9 defects;
10 based on the measured parameter, scaling such input
11 image data to compensate for said departure; and
12 printing such image using the scaled input image
13 data.

1 26. The method of claim 25, wherein:
2 the parameter comprises such print-quality defects;
3 and
4 the measuring step comprises measuring such print-
5 quality defects.

1 27. The method of claim 26, wherein:
2 the defects comprise swath-height error; and
3 the measuring step comprises measuring swath-height
4 error.

1 28. The method of claim 26, wherein:
2 the defects comprise area-fill nonuniformity; and
3 the measuring step comprises:
4
5 using a sensing system to measure area-fill non-
6 uniformity for plural printing-medium ad-
7 vance values, and
8
9 selecting a printing-medium advance value that
10 corresponds to minimum area-fill non-
11 uniformity.

1 29. The method of claim 25, wherein:
2 the parameter comprises such optimum value; and
3 the measuring step comprises determining such optimum
4 value.

1 30. The method of claim 25, for use with said at least
2 one scanning multielement printing array that comprises a
3 plurality of multielement printing arrays that print in a
4 corresponding plurality of different colors or color dil-
5 tions, each multielement printing array being subject to a
6 respective swath-height error; wherein:

7 the measuring, scaling and printing steps are each
8 performed with respect to each multielement printing array
9 respectively.

1 31. The method of claim 30, wherein the printing step
2 comprises:

3 comparing optimum advance values or swath-height
4 values measured for the plurality of multielement printing
5 arrays respectively, to find the smallest of said values;

6 selecting a particular multielement printing array
7 whose said value is substantially the smallest;

8 using, in common for the plurality of printing ar-
9 rays, substantially said selected smallest value; and

10 for substantially each array other than the particu-
11 lar array, operating with a respective reduced number of
12 printing elements and with rescaled data, to match an ac-
13 tual effective swath height of the particular array.

1 32. The method of claim 31, wherein:

2 said smallest of said values is determined taking in-
3 to account the maximum available number of printing ele-
4 ments in the corresponding array.

1 33. The method of claim 25, further comprising the step
2 of:

3 after the scaling step, iterating the measuring and
4 scaling steps to allow for nonlinearity in such print-
5 quality defects.